

epiTRENDS

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Preventing an Influenza Pandemic

What is the relationship among seasonal, avian or pandemic influenza? What do we know about preventing the spread of pandemic influenza?

Seasonal influenza is the widespread human viral illness occurring annually with significant morbidity and mortality. Influenza A or B viruses can cause seasonal influenza. These viruses undergo minor changes each year, requiring annual reformulation of the influenza vaccine to provide adequate protection.

Avian influenza is a common infection among birds caused by many different strains of influenza A viruses. These viruses occasionally infect other species, e.g., pigs, horses and humans.

Pandemic influenza is a multi-continental outbreak caused by a new influenza virus. Such a virus would most likely emerge from influenza A that originally infected birds or animals. Pandemic viruses spread quickly because most people lack immunity to the virus. The worldwide mortality in the 1918-19 pandemic has been estimated to be as high as 100,000,000 people. It is impossible to predict the outcome of a pandemic today – much depends on the characteristics of the virus (transmissibility, virulence, etc); the availability of vaccines, antiviral medications, antibiotics for secondary bacterial infections, and healthcare resources including mechanical ventilators; and global spread of the virus by asymptomatic, infected travelers.

Influenza A

Influenza is a single-stranded RNA virus with the ability to infect a broad range of animal species. Influenza A viruses are subtyped based on the surface proteins hemagglutinin and neuraminidase and referred to by their H and N designation, for example H1N1 or H5N1. Humans are usually infected by influenza A subtypes H1-3 while birds can be infected by all 16 H subtypes.

Influenza A viruses tend to change because they can infect more than one species and can share their RNA. When multiple strains of influenza infect a single host, a process known as reassortment can occur – RNA from one strain is exchanged with that of another. This process may lead to significant modifications in viral characteristics, resulting in a new virus for which humans lack immunity.

Since 1993 when the avian influenza A virus H5N1 was first described in Hong Kong, millions of birds in Asia, Europe and Africa have been infected. Despite multiple opportunities for exposure, relatively few humans have been infected by this avian virus. However, concerns remain that the H5N1 virus has the potential to undergo reassortment and cause an influenza pandemic.

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If that should happen, how effective will prevention measures be? As outlined by the World Health Organization (WHO) Writing Group, interventions that may limit the spread of influenza include pharmaceutical and non-pharmaceutical measures, but none are magic bullets.

Preventive Measures, Pharmaceutical

Vaccine: To develop an effective vaccine, current technology requires the exact strain of influenza as a target; because no pandemic virus currently exists and an exact structure cannot be predicted, there will probably be a delay before adequate supplies of effective vaccine are available. The National Institutes of Health and vaccine manufacturers are developing newer methodologies for vaccine production that may overcome this obstacle.

Antivirals: The H5N1 influenza virus appears to be resistant to older M2 inhibitors (amantidine and rimantidine) and few data exist regarding the efficacy of neuraminidase inhibitors (oseltamivir [Tamiflu®] and zanamivir [Relenza®]). There is no certainty that any antiviral medication will be effective against a pandemic virus. In addition, costs associated with purchasing and stockpiling antivirals are not insignificant, especially for state and local public health agencies with limited resources.

Preventive Measures, Non-Pharmaceutical

So what about non-pharmaceutical interventions? Some evidence suggests that early in a pandemic, measures such as isolation, quarantine, infection control, and “social distancing” might reduce disease spread.

Isolation: Isolation of ill patients and infection control measures have both been shown effective in reducing the transmission of many infectious agents. Although quarantine of contacts exposed to SARS worked well, quarantine is unlikely to be effective in preventing the spread of influenza; unlike SARS, influenza virus can be transmitted up to two days before symptoms develop, making it difficult to identify all situations in which exposure to influenza occurs. During 1918-19, quarantine may have been effective in remote areas; travel restrictions appear to have had little effect in Canada and Australia on the progression of the pandemic. Screening travelers for respiratory illness during the 2003 SARS outbreak had mixed results. After reviewing experiences with exit screening of travelers from SARS-affected countries, WHO concluded this intervention may be effective during the early phases of a pandemic.

“Social Distancing”: Social distancing includes actions such as closing schools and cancelling large events or gatherings. Most data supporting social distancing as an intervention are inferential. WHO noted in 1959 that pandemics initially appear among persons in crowded conditions, such as military barracks and schools while attack rates during pandemics were lowest in rural areas and during summer school closures. Seasonal influenza morbidity has been reported to decline during teacher’s strikes. However, social distancing measures did not appear to have an effect in reducing transmission of influenza in Canada, Africa, and the United States during 1918-19.

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Hand and Respiratory Hygiene: Programs to encourage hand and respiratory hygiene have both been shown to be effective in reducing the risk of respiratory viral infection. Studies among military recruits and college students found decreased rates of respiratory illness following implementation of handwashing programs while initiating a respiratory hygiene program in healthcare waiting areas was shown to decrease the spread of respiratory syncytial virus and pertussis. Respiratory hygiene programs are appropriate for all health care settings. "Cover Your Cough" posters are available at the DOH website below.

Masks: Although everyone really wants to know about facial masks, it's astounding how little is known about their efficacy in preventing influenza in healthcare settings, much less in community settings. The National Academies of Sciences' Institute of Medicine (IOM) expert panel concluded that more research is needed but noted that disposable masks should not be reused and that cloth masks, (especially if home-made) may not prevent transmission by droplets or splashes and could provide a false sense of protection for the wearer. The IOM, much like the Centers for Disease Control and Prevention, decided that they could neither recommend nor discourage the use of masks for the public.

Conclusion

In summary, more research is needed to determine the usefulness of many of the proposed prevention methods in preventing spread of influenza during a pandemic other than washing hands and covering coughs. Some of these methods will be costly and socially disruptive. In addition, they may not actually reduce the morbidity and mortality of a pandemic.

Further information is available online at:

<http://www.doh.wa.gov/panflu/default.htm>

<http://www.pandemicflu.gov/>

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2. WHO Writing Group. Nonpharmaceutical interventions for pandemic influenza, national and community measures. *Emerg Inf Dis* 2006;12:88-94.